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CLEAN VERSION OF PENDING CLAIMS

MONOLITHIC NANOFLUID SIEVING STRUCTURES FOR DNA MANIPULATION
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1. [Amended Once] A method for fabricating a fluidic system, comprising:

depositing a floor layer on a first surface of a substrate;

depositing a silicon sacrificial layer on the first surface of said floor layer;

patterning said silicon sacrificial layer to define in the silicon sacrificial layer the shape of a desired fluid working gap;

depositing a ceiling layer to cover said silicon sacrificial layer; and

removing said silicon sacrificial layer from between said floor layer and said ceiling layer to produce said working gap.

2. [Amended Once] The method of claim 1, wherein removing said silicon sacrificial layer includes:

providing at least one access hole leading to said silicon sacrificial layer; and

etching said silicon sacrificial layer through said at least one access hole.

3. [Amended Once] The method of claim 2, wherein providing said at least one access hole includes forming at least one hole through said ceiling layer to said silicon sacrificial layer.

4. The method of claim 3, further including depositing a sealing layer over said ceiling layer to close said at least one access hole.

5. [Amended Once] The method of claim 1, wherein patterning includes:

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defining in said sacrificial layer the boundaries of a fluid chamber working gap; and

defining within the boundaries of said fluid chamber a multiplicity of holes extending through said silicon sacrificial layer to said dielectric floor layer.

6. The method of claim 5, wherein depositing said ceiling layer includes depositing the ceiling layer in said multiplicity of holes to define obstacles in said working gap.

7. [Amended Once] The method of claim 6, wherein removing said silicon sacrificial layer includes etching said silicon sacrificial layer between said obstacles in said working gap to produce an artificial gel.

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8. [Amended Once] The method of claim 1, further including, after depositing said dielectric ceiling layer:

patterning and etching said ceiling layer to form a ridge waveguide intersecting the location of a desired fluid working gap;

patterning and etching said ceiling layer to define at least one access hole leading to said sacrificial layer; and

thereafter removing said silicon sacrificial layer by etching.

9. [Amended Once] A method for fabricating a multilevel fluidic device, comprising:

forming a first floor layer; depositing a first sacrificial layer on a first surface of said floor layer;

patterning said sacrificial layer to define in the sacrificial layer the shape of a desired fluid working gap;

depositing a ceiling layer to cover said sacrificial layer;

patterning said second sacrificial layer to define in the second sacrificial layer a second

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desired fluid gap;

depositing a second ceiling layer to cover said second sacrificial layer; and

removing said sacrificial layers to produce multilevel working gaps wherein at least one of the sacrificial layers is a silicon material.

10. The method of claim 9, further including depositing additional patterned sacrificial and ceiling layers sequentially to produce additional working gap levels.

11. The method of claim 10, further including producing at least one vertical connector hole through a ceiling layer to interconnect adjacent sacrificial layers.

12. The method of claim 11, further including producing at least one vertical connector hole through each ceiling layer that receives a sacrificial layer on each level to the sacrificial layer on a next adjacent layer.

13. The method of claim 12, wherein removing said sacrificial layers includes:

providing at least one access hole leading to at least one of said sacrificial layers; and

etching all said sacrificial layers through said at least one access hole and said at least one vertical connector between each level.

14. The method of claim 13, wherein providing said at least one access hole includes forming at least one access hole through the topmost ceiling layer to the sacrificial layer covered by said topmost ceiling layer.

15. The method of claim 14, further including depositing a sealing layer over said second ceiling layer to close said at least one access hole.

16. The method of claim 9, wherein patterning includes:

defining in at least one of said sacrificial layer and said second sacrificial layer the boundaries of at least one fluid chamber working gap; and

defining within the boundaries of said at least one fluid chamber a multiplicity of holes extending through a corresponding sacrificial layer.

17. The method of claim 16, wherein depositing said first and second dielectric ceiling layers includes depositing the ceiling layer in said multiplicity of holes to define obstacles in said at least one fluid working gap.

18. The method of claim 17, wherein removing said sacrificial layer and said second sacrificial layer includes etching said between said obstacles in said at least one working gap to produce an artificial gel.

19. The method of claim 9, further including, after depositing said ceiling layer:

patterning and etching said ceiling layer to form a ridge waveguide intersecting the location of a desired fluid working gap; and

patterning and etching said ceiling layer to define at least one access hole leading to said sacrificial layer.

20. The method of claim 1, further including fabricating on said substrate a device for interconnection with said working gap.

21. The method of claim 20, wherein fabricating said device is carried out by a process compatible with the process of fabricating said working gap.

22. The method of claim 21, further including interconnecting said working gap with said device to allow fluid transfer between said gap and said device.

23. A method for fabricating a nanochannel, comprising:

patterning and etching a substrate to produce a surface having a vertical sidewall intersecting the substrate at the base of the sidewall;

depositing a thin film conformal sacrificial layer on said substrate and covering said sidewall, the thickness of the thin film at the base of the sidewall having an increased thickness and width to form a sacrificial wire along the base;

removing by an unmasked RIE the thin film sacrificial layer on the sidewall and on the substrate, while leaving said sacrificial wire along said base;

depositing a ceiling layer on said substrate and said sidewall and covering said wire; and

removing said sacrificial wire to produce a nanochannel between said substrate, sidewall, and ceiling layer.

24. A method for forming a nanochannel, comprising:

depositing a thin film silicon sacrificial layer on a substrate;

patterning said silicon layer to define a sacrificial wire having the shape of a desired nanochannel;

oxidizing the patterned sacrificial silicon layer to reduce the width and height of the sacrificial wire bay consuming silicon from the surface of the wire to form a silicon oxide coating; and

removing the sacrificial wire from within said silicon oxide coating to produce a nanochannel.

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25. [Amended Once] A method of forming a fluidic system, the method comprising:

forming a patterned silicon based sacrificial layer on a substrate;

forming a ceiling layer on the patterned sacrificial layer; and

removing the patterned sacrificial layer.

26. The method of claim 25 wherein the substrate comprises a floor layer forming a floor of

the fluidic devices.

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27. [Amended Once] A method of forming a fluidic system, the method comprising:
forming a patterned silicon based sacrificial layer on a substrate;
forming a ceiling layer on the patterned silicon based sacrificial layer;
forming access holes through the ceiling layer to the patterned silicon based sacrificial layer; and
removing the patterned silicon based sacrificial layer via the access holes.

28. The method of claim 27 wherein the fluidic system is defined by the ceiling layer and substrate.

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29. [Amended Once] The method of claim 27 wherein the substrate comprises a floor layer forming a floor of the fluidic system.

30. [Amended Once] A method of forming fluidic systems, the method comprising:
forming a patterned sacrificial layer on a substrate;
forming a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer;
removing the patterned sacrificial layer via the access holes; and
covering the access holes such that the fluidic systems are defined by the ceiling layer and substrate.

31. [Amended Once] The method of claim 30 wherein the substrate comprises a floor layer forming a floor of the fluidic systems.

32. [Amended Once] The method of claim 30 wherein the ceiling layer comprises a dielectric material.

33. [Amended Once] The method of claim 30 wherein the sacrificial layer comprises amorphous silicon or polysilicon.

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34. [Amended Once] The method of claim 30 wherein the fluidic systems comprise channels.

35. [Amended Once] The method of claim 30 and further comprising forming further fluidic devices on top of the already formed fluidic systems and forming interconnects therebetween.

36. [Amended Once] The method of claim 30 wherein the layers are formed using chemical vapor deposition.

37. [Amended Once] The method of claim 37 wherein the sacrificial layer is removed by providing an etchant through the access holes.

38. [Amended Once] The method of claim 37 wherein the etchant comprises tetramethyl ammonium hydroxide.

39. [Amended Once] A method of forming fluidic devices, the method comprising:
depositing sacrificial layer on a substrate;
lithographically patterning the sacrificial layer;
depositing a ceiling layer on the patterned sacrificial layer;
forming access holes through the ceiling layer to the patterned sacrificial layer;
etching the patterned sacrificial layer via the access holes; and
oxidizing the access holes.

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40 ~~41~~. [New] A method for fabricating a fluidic system, comprising:

depositing a floor layer supported by the surface of a substrate;

depositing a sacrificial layer on the surface of the floor layer;

defining in the sacrificial layer the boundaries of a fluid chamber working gap; and

defining within the boundaries of the fluid chamber a multiplicity of holes extending through said sacrificial layer to the dielectric floor layer;

depositing a ceiling layer to cover the sacrificial layer, wherein the ceiling layer is deposited in the multiplicity of holes to define retarding obstacles in the working gap; and

removing the sacrificial layer from between said floor layer and said ceiling layer to produce said working gap having the retarding obstacles.

41 ~~42~~. [New] The method of claim 40 ~~41~~, wherein removing the sacrificial layer includes etching the sacrificial layer between the retarding obstacles in the working gap such that the retarding obstacles significantly influence the motion of molecules.

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42 ~~43~~. [New] A semiconductor processing method of forming a nanochannel, comprising:

depositing a thin film silicon sacrificial layer on a substrate;

patterning the thin film silicon sacrificial layer to define a sacrificial channel having the shape of a desired nanochannel;

depositing a ceiling layer to cover the sacrificial channel; and

removing the sacrificial channel from under the ceiling layer to produce a nanochannel.

43 ~~44~~. [New] The method of claim 42 ~~43~~ wherein the sacrificial layer has a thickness between approximately 120 nm and 540 nm.